



System Safety in Healthcare

by Maria C. Escano, M.D. and Dev Raheja

Electronic Medical Record Assimilation and Integration

Electronic Medical Records (EMR) are the digital version of paper charts. They are the electronic record of an individual's health-related information that is created, gathered, managed, and consulted by licensed clinicians and staff [Refs. 1-3]. This article will focus on some of the challenges of health record integration between often disparate systems — internally, across a mix of systems, or externally, such as entities ranging from federal and state agencies, insurance companies, physician practices, medical facilities and pharmacies. The challenges of data collection, assimilation and integration remain at the forefront of our electronic medical record era [Refs. 1, 6-9]. Seamlessly moving information across disparate information systems becomes even more challenging when the data involves confidential medical information.

According to the Institute of Medicine, an EHR is a system with core functionalities that include health information and data, results management, order entry and decision support [Ref. 1]. There is a dream of “health information perfection,” where patient information is seamlessly integrated. The ideal system provides point-of-care information in a cost-effective, efficient and effective fashion, allowing patient-specific services and processing of multi-system care across all inter-related disciplines to provide high-quality, safe, effective and error-free individualized patient care.

This is, indeed, a dream.

For some physicians — like those in solo or small practices with limited resources, or clinicians with busy loads who lack informational technology (IT) support — health information technology provides a different experience. Their experience is of a busy waiting room and little time to spend with patients because of the time demands of EMR documentation and assimilation, often while on hold for IT support.

The use and system-wide implementation of computer-based systems, such as computerized physician order entry systems, have been examined in dif-

ferent studies, with mixed results. Some commercial systems used by health care institutions suggest significant benefits, while others hint at potential risks. One study regarding EHRs and health information technology (HIT) showed that implementation of a multifunctional electronic health record can improve care that adheres to previously established protocols, guidelines and disease monitoring. In addition, medical errors decrease and health care utilization is improved [Ref. 11]. However, in another study, the introduction of a computerized physician order-entry system at a hospital showed an increase in certain types of medication errors [Ref. 4]. In one pediatric intensive care unit (ICU), the introduction of EHR was even associated with an increase in mortality [Ref. 5].

Despite all these roadblocks, using technology to streamline data management has its benefits, although adaptation can be complex and sometimes slow. HIT has generated a flurry of interest and activity among public and private health care groups, the government and commercial companies [Ref. 6, 12].

Data Integration and Assimilation

The assimilation process is a harm-prevention process commonly called the risk-prevention process. It was originated by the aerospace industry and the U.S. Department of Defense, and has potential applications in health care — though it is not always used. The Joint Commission has suggested that a tool called Failure Mode and Effects Analysis (FMEA) be used at least once a year on a critical process. In our view, this tool should be used on *all* critical processes. Other potentially useful harm-prevention tools are Preliminary Hazard Analysis (PHA), Fault Tree Analysis (FTA) and Operations & Support Hazard Analysis (O&SHA).

Preliminary hazard analysis can be used to predict all potential scenarios where EMRs lead to unsafe decisions, communications, etc. FMEA looks at what can go wrong at every step of a process and prevents these



“Data acquisition and record-keeping often occurs in different formats, with different codes and different vocabularies. For example, a physician may use ‘elevated blood pressure’ in one document and ‘hypertension’ in another. Some practitioners may document ‘elevated sugars,’ but another may write ‘high finger sticks.’ Before integration can occur, data standardization is needed to create universally accepted standardized diagnosis coding and billing systems, map codes sets, and privacy and security protocols.”

hazards from happening. FTA looks at the combination of causes that can result in incorrect assimilation, and aims to prevent combined causes from occurring at the same time. According to safety theory, a combination of two things has to happen for a harmful event to occur. Many EMR physician order-entry programs have built-in systems that alert a physician when a medication is listed as an allergy. An additional safety mechanism also alerts the pharmacy of potential medication allergies prior to dispensing. The combination of these two systems help prevent errors from happening. An effective way to encourage safety practices is to introduce these tools early, as prevention is key.

Data Entry and Retrieval

Digitizing medical records to allow clinicians to input and collect data in an electronic format is just the tip of the iceberg. It is one thing to document a note in a computer and then retrieve it later. How about virtual EMR? The Veterans Administration (VA) Hospital integrates its EMR platform into a Virtual Lifetime Electronic Record (VLER). This allows some hospital systems and providers secure electronic access to veterans’ health records stored at any of VA’s healthcare facilities nationwide. This system aims to provide up-to-date medical history and patient information. In this system, veterans’ participation is strictly voluntary and requires in-person authorization [Ref. 3]. A health information system that allows data to be retrieved, organized, assimilated and cross checked — and decision algorithms to be applied — gives the healthcare practitioner the ability to provide accurate, timely, high-quality care at the bedside of a patient evaluated emergently across town. Outside the VA system, patients don’t have a

national medical record number that allows unique patient identification between hospitals, regions, states or across the nation. Rapid medical records retrieval can be a challenge.

Language barrier?

Benefits of Data Standardization

Data acquisition and record-keeping often occurs in different formats, with different codes and different vocabularies. For example, a physician may use “elevated blood pressure” in one document and “hypertension” in another. Some practitioners may document “elevated sugars,” but another may write “high finger sticks.” Before integration can occur, data standardization is needed to create universally accepted standardized diagnosis coding and billing systems, map codes sets, and privacy and security protocols. Standardizing these complex data sets will allow different systems to manage information obtained from different sources. It will also assist in ensuring that the same type of information is collected and processed.

Data Information Integration, Assimilation and Patient Access

A system that allows data to communicate or be interconnected across institutional and geographic boundaries is complex. Open platforms that tie into information from a variety of disparate systems, requiring less investment and preserving existing computer infrastructure intact, might be more acceptable and beneficial. Web-based applications have been suggested, but keeping data confidential and secure remains of prime importance — and challenging.

Technology that can assimilate and summarize the simultaneous presence of two or more morbid conditions or diseases (comorbidities), as well as diagnoses and diagnostic results that exist in various EMRs, EHRs and payer databases for the patient across different entities is a useful tool. The Medicare Blue Button is one attempt to provide a developer-friendly, standards-based data application programming interface (API) that enables beneficiaries to connect their Medicare claims data to applications, services and research programs [Ref. 13]. This service was established as a joint effort of the Center for Medicare and Medicaid Services (CMS) and the U.S. Department of Veterans Affairs (VA). In this system, CMS is engaging in a program that has a wide range of applications, which allows data interface with third-party applications, services and programs in a rich, yet simple, flexible format.

References

1. "What is an Electronic Medical Record (EMR)?" HealthIT.gov, September 22, 2016, <https://www.healthit.gov/providers-professionals/electronic-medical-records-emr>.
2. Laurent, Dan. "AHN and VA Integrate Electronic Medical Records," Allegheny Health Network, March 16, 2017, <https://www.ahn.org/news/3-16-2017/ahn-and-vb-integrate-electronic-medical-records>.
3. Koppel R, J.P. Metlay, A. Cohen, et al. "Role of Computerized Physician Order Entry Systems in Facilitating Medical Errors," *Journal of the American Medical Association*, 293, pp. 1197-1203.
4. Han, Y.Y., J. A. Carcillo, S.T. Venkataraman, et al. "Unexpected Increased Mortality After Implementation of a Commercially Sold Computerized Physician Order Entry System," *Pediatrics* 2005, 116, pp. 1506-1512 (Erratum, *Pediatrics* 2006, 117, pp. 594).
5. Bush, George W. "Executive Order: Incentives for the Use of Health Information Technology and Establishing the Position of the National Health Information Technology Coordinator," The White House, Washington, DC, April 27, 2004.
6. Brailer D.J. "The Decade of Health Information Technology: Delivering Consumer-centric and Information-Rich Health Care," U.S. Department of Health & Human Services, Washington, DC, 2004.
7. Blumenthal D. and J.P. Glaser. "Information Technology Comes to Medicine," *New England Journal of Medicine*, 2007; 356: pp. 2527-2534.
8. Hersh W. "Health Care Information Technology: Progress and Barriers," *Journal of the American Medical Association*. 2004; 292: pp. 2273-2274.
9. Poon E.G., et al. "Overcoming Barriers to Adopting and Implementing Computerized Physician Order Entry Systems in U.S. Hospitals," *Health Affairs*. 2004; 23: pp.184-190.
10. Chaudhry B., et al. "Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care," *Annals of Internal Medicine*, 2006; 144: pp. 742-752.
11. Centers for Medicare & Medicaid Services. "Electronic Health Records (EHR) Incentive Programs," July 13, 2017, <https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html>.
12. Centers for Medicare & Medicaid Services. "Blue Button on FHIR: Improving Medicare Beneficiary Access to Their Health Information," July 4, 2016, <https://www.cms.gov/Research-Statistics-Data-and-Systems/CMS-Information-Technology/Blue-Button/index.html>.
13. Institute of Medicine. "Key Capabilities of an Electronic Health Record System," National Academies Press, Washington, D.C., 2003.

The Future

The use of health information technology across industries, hospitals, government, insurance companies and health care providers is attractive, but boils down to providing the best care for the patient. The capacity of health information technology to assimilate data into simple, usable information remains a challenge. Various coordinated efforts to address myriad issues while keeping data confidential and secure are needed. With all these technological advances, let us not forget that while we stare at a computer, the health care needs of the patient, and not the computer screen, should remain at the forefront of our attention.

“The use of health information technology across industries, hospitals, government, insurance companies and health care providers is attractive, but boils down to providing the best care for the patient. The capacity of health information technology to assimilate data into simple, usable information remains a challenge.”

Acknowledgements

Appreciation to Mark Gorman and Joan Kies for sharing their expertise in patient safety. ●